

Readings in Cell Physiology

A. Colchicine

B. Mitosis

C. Enzymology (functional) + Protoplasm

D. The Physical Chemistry of Biological Processes

E. Chemistry, miscellany

F. Class references

G. Bacteriological

H. Genetics...

J. S. LEDERBERG, A.B. 12 USNR
COLLEGE OF PHYSICIANS & SURGEONS
630 W. 168 ST., NEW YORK 32, N. Y.

Joshua Lederberg
Columbia College

If this book is found, please return it to
Cytology Laboratory, 905 Schermerhorn Extension
Graduate Laboratory, Zoology, 1005 Sch Ext.

A. Colchicine

0. Chemistry and Pharmacology
1. Caryocinesis & organismal reactions
2. C-mitosis, etc. Phylogeny
3. Physiological correlations
4. Genetic progress with
5. Physical or Chemical theory
6. Other c-agents
7. Misc. and Application

B. Mitosis

0. Descriptive Morphology
1. Physical measurements (see also 7)
2. Chemical stimuli, specific + phy 7c
3. Sulfhydryl hypothesis; "growth", ... see also 6C
4. Tumours and cancer conditions; carcinogens
5. Promitosis, Animitosis, etc.
A. Nicot, etc. C. Misc
6. Toxicology B. other inhibitors D. hormones
7. Physical Agents, X-rays, Neutrons, etc
8. Anaerobic conditions
9. Energy metabolism see also 6A, B
10. Chromosome metabolism
11. "Genetic Abnormalities"

① General Biophysics

1. Kinetics & Thermodynamics

2. Diffusion

3. Mathematical

4. Bioelectricity

5. Membrane

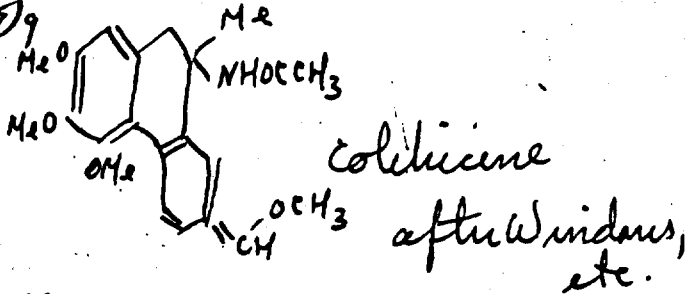
6. Viscosity, etc. Gel...

Clark + Barnes '40 PSEBM 44:340 colch

poisoning in dogs treated a for adrenal cortical insufficiency.

Henry '39 The Plant Alkaloids Churchill

p574-579



Klein + Pollack '29 Abst. Bot 2. 78:250

10% silicotungstic ac. + HCl → cryst. balls.

5% PtCl₄ + 5% HSCN → crossed needles. CHCl₃-

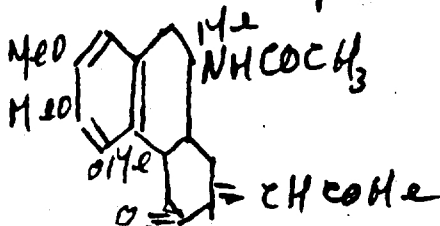
NH₄OH extracts. Colch found in various Liliaceae, *Ornithoglossum*, *Colchicum*

Robinson '05 JBC 1:542 Toxicity of colch and salts on *Gammarus*.

Schiffley + Higgins '40 Pt Mayo Cl 15:536

colch more toxic in hepatectomies.

Fyfe '39 Imp. Bu Pl Br + Gen.



Chodkowski '37 Pr 28:597 Review of
chole.

Chodkowski '39 Arch int Med exp 13:665

Saponin as a coagulant against

Delcourt '38 Arch int Med exp 13:719

colch in amphibia high fat deposition

in liver. Dietrich theory

Leblond + Sagal '38 CRSB 128:995 Colch pro-

vokes the alarm reaction (involution of thymus)

hypoplasia of adrenal) as a non-specific poison

Fitz '36 Arch int Med exp 11:811-901 Dietrich

theory: white mouse

75:189

Beano + King '38 BB. Paramecium
not affected. Triticum

79:188

140 BB. .0002M, 22m after
fertilization, stop at bacia

140 JCCP does not affect

Paramecium or amoeba

Boas + Sistle '39 P. 33:301 Flax, pea type
reaction. Geotropism reversed by eosin
contracted (?) Inhibits eosin fluorescence!

Comman '44 BB1:297. Colechicum au-
tumnale affected at 10%, C. byzantium
and 5% concentrations.

✓ Dooley '41 T.A.M.S. 60:105 Melanophus +
Gryllus! (Orthoptera) Giant Spinn, P-41 fil.
Mitochondria short thickened rod. Golgi
swollen. Does differentiate, without
division in germ cells!

Bureau + Vilter '39 CRSB 132:553 Ambystoma
c-mitosis; no stimulation of CD. in epithelium

Hoppel + Dawson '39 BB 76:153 Rana pipiens
Various chromosomal at lower concentrations.

✓ Levan '38 Hereditas 24:471 Allium root tip

✓ " '39 Hereditas 25:9 meiosis

✓ Ludford '36 Arch exp 26:18:411 — also
similarities with urethane, cacodylate,
auramine and colchicine.

✓ O'Mara '39 JH 30:35 Allium smears —
good illustrations.

Paff '39 Ann J Anat 64:331 Chick embryos.

0.0045 g. is sublethal dose. Overgrowth, indica-
ting greater cell proliferation, under the action of
colchicine, invalidating Allen, etc.

Vandendries + Vandendries '39 CRAS 208:1675

eff on: Euglena, Chlamydomonas, Saccharo-
myces, Psilocybe, Stropharia, B. subtilis, etc.

Walker '38 J. Ann. Arb. 19:158 T. adsc.

✓ X

Walker + Youmans '40 PSEBM 144:271

Bacteria : none.

Walsby CA 35:1128⁸ Raou.

1:5000 severe effect 22 hrs. O.C. not changed.

Beust + Jackson '37 A.J. Cane 30:504

Sarcoma 180+ mouse liver

7 stages defined + time maxima. comp

Tennant + Liebow '40 Yale JBM 13:39

Tissue culture. type c-vitosis described
compared with EBK + Pastur Reaction

Wolcott '41 JHI 32:67 Pallavicinia lyelli

(hepatocae) c-vitosis; contraction and
clumping of chromosomes. In sparse mother cells
independent cell divisions.

Comman, I. Bot. Gaz. 104:50 (1942) Resistance
of *Zobellium* sp.

Creungas + Ott J. H. 33:63 (1942) Desosiphia
vitosis. c - scattered

Sparrow AH Science 96:363 (1942) inhibits
chemata in *Antirrhinum majus* L.

Catney + Young J. Paras. 15:446 (1937) Plasmodium
relitum (bird malaria). No effect.

Hawkes, MA J. Gen 44:11 (1942) Allium

Freud + Nylander Acta Brevia Neuland

8:16-19 1938 Pato; ahenalictomy

Jevins + Selber Torreybull 70:175 (1943)

Metaphase stage: c-root hypomoni. Counts;
unilluminating

A2

258-271

Barber & Callan PRSB 131 Colchicine
and cold on new epidemal mitoses.
See report. Theoretical Karyokinesis.
Good photos.

Comandon & deFonbrune CRSB 136: 410-11 '42

1% on Anacrasphacornucleus.

in medium: no effect; injected at equatorial
late stage: stains of doubled ring which
usually died out.

Boydland + Boydland '37 Beich. J. 31. Anasarcoma

Colchicine lowered indophenol reducing power of liver, intestine; not of brain or testis. ^{graft} No tumours, hemorrhagy leading to low oxidations. *in vitro* .03% colch reduced O.C. Colchicine more effective

Brach, Brudney, Heblain '39 Arch exp Pathol Pharm

Spongylentotus *in vitro* 500x dose for CD, no effect on O_2 .

Gumöcher '40 CRAS 210:579 kinases

osm pressure in Triticum 7.1 to 11.1 atm.

pH vacuole 4.9 - 4.6, pH cytoplasm 5.4 - 5.2

Patton + Nibel '40 AJB 27:612 Colch depross

glycolysis at $10^{-4}M$, $\frac{1}{2}$ O.C. at 4×10^{-4} ; 2×10^{-4}

has no effect.

proteolysis [lipoptase: clary glycosid]

Beggs, Bleeker, Arney '40 ASB *Datura*
 following obtained from table:

$2n-1, 2n+1, 2n+1+1, 4n+1, 4n-6(1),$
 $4n-2-2-1, 4n-2-1-1-1, 4n-2-1-1,$
 $4n-2-2, 4n-1-1-1, 4n-2-1, 4n-1-1,$
 $4n-2, 4n-1$

Law, PNAS 24:546 (1938) No effect on
 lethal mutation rate in *Drosophila*

Physical reactions, etc. & Theory

Beams + King '38 Biol Bull colchicine

lowers viscosity in *Tritium* dividing cells.

Hal '38 BSCB 20 Carodylate has no

effect; colchicine inhibits preparation of lactic and citric dehydrogenase. No effect on succinate, glucose, or glycogen dehydrogenases.

Lein '41 - '42 B.R.C.N.Y. 4:1 Colchicine

lowers the viscosity of *G. F. Glycera* eggs in hypotonic sea water. Other gels (*in vitro*) not affected.

Smith '41 Okla Ac Sc Pr 21:105 Colch did

not inhibit diastase or invertase.

acids from pH effects. and surface tension

Wada '41 Cyt. 11:93 Viscosity of "attracto-plasm" reduced.

Wilbur '40 PSEBM 45:696 Cntr. method

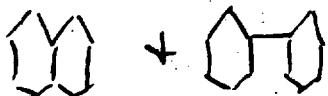
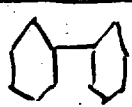
Colch reduces mitotic viscosity only, by 60% at first, which later catches up!

Branch '42 Fed. Proc. II (39) Saccoma 37.

12 similar compounds tested. Mitotic shower (char!)

Quadrin '37 J Pathol Bact 44:469 Cole

Gavaudan² + Durand '39 CRSB 130:53

 +  similar effects. few details.


Gavaudan² '39 CRSB. Listed: acenaphthene
ethylmagnesium phosphate, $\phi\text{NHCOOEt}$, ϕCl_2 ,
heterocoumarin, $(\text{CH}_3)_3\text{AsONa}$, $\phi\phi$, $\alpha\text{Cl}-\phi\phi$

Gavaudan² '39 CRSB 130:432 comparison
with $\text{CCl}_3\text{CHOH}_2$ inconclusive.

Ass '37 Phytopath. 27:95 ethylmagnesium
phosphate \rightarrow polyploidy, multinucleate cells.

Spindle + fragments are discernible.

Simonet + Gimochet '39 CRSB 130:1057

 Spindle not inhibited although
cl end results are like colchicine.

Nuclear fission.

Bates '39. Nature 143: 643 colchicine polyploids

in nature? No.

Jorné : '45. Bot. Rev. - Colchicine +

X Ray in New Growth.

Chackin '37 J Path. Bact 44:469 Colic can
not be used in treating tumours ~~in vivo~~
other tumours more affected
Fahr and Riddle AJP 123:614 (1938) Crop
cultures in pigeon, endocrine analysis with
colicine.

Bucrow's '27 A.J. An. 39:83 "achusia-argusia relationships. "Cell-environment" complex. no contribution

Chambes '17 J. exp. Zool 23:483 cell actin is a thixotropic gel. Centres + rays are fluid. Division by growth of asters.

Chambes '38 JCCP 12:149 Cell Division in *Cheimodum*: polar streaming, cortical growth
Cooper '41 PNAS 27:480 Spindle fibres readily seen in living elastomers of *Pediculus geminatus*. No centrioles or asters.

Foot & Strohbell '05 A.J. Anat. 4:199 Spines of *Allobophora foetida* let the spindle flow out as an intact structure

Lamb '08 J. exp. Zool 5:27 Hydrodynamics: oscillating centers.

Heck '13, JMS 58:567 General

Pratt & Malkovskiy '27 Pr 2:312 :::

Moore '33 J exp 2 10: 230 experiments on
Dendroaete x Stongylocentrotus crosses indicate
that cleavage rate is determined by the egg cytoplasm.

Cannon '23 J. Gen. 13: 47 extensions of
Lamb's hypothesis.

Ris J Exp Zool 90: 267 (1942) Aphid meiosis
Hughes-Schader & Ris J Exp Zool 87: 429 (1941)

Coccid meiosis: diffuse binit or bore.

Stough, JM 52: 535 (1931), 58: 221 (1935)

Modified mitosis

Lucas & Stork JM 52: 91 (1931) UV photos

Hughes-Schader J Morph 39: 157 (1924)

Acroschizismus

Mety Ann Natur. LXXII (743) 485 1935
Scara

Mety Bid Bull 644: 333 (1933) Scara

Scott J Morph 59: 485 1936 Micromalthus

Mety Cytologia 7: 217 (1935) Scara

Darlington, J. Gen. 37: 341 (1929) Misdivision

Wilson J Morph 53: 443 1932 Polyploidy + mit. patt.

White PRSB 125: 516 '38 Meiosis in Callinectes

Koewen BB 43: 184 1922 polyploidy in bugs

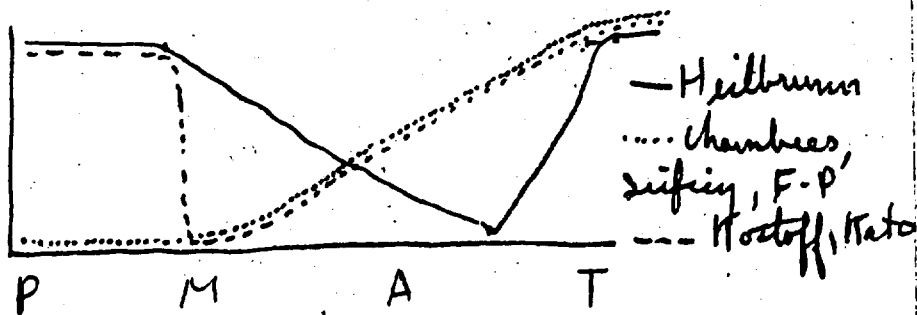
Physical Observations

Bailey '39 Chromosoma (11): 37 rate of chromosome movement measured. $\approx 5 - 3 \mu$ / minute in different tissue

Dan, Yanagita, and Sugiyama '37 Pr 28:66 movement of bacilli particles followed. Differential stretching of cortex in C.D.

Vles '27 CMB 85:494 index of refraction n of 1.405 in late anaphase. v infer

Fry + Poles '34 Pr 21:473 Viscosity curves in Mitosis, by centrifuge. Summarized:



Heilbrunn '20 J. Exp. Zool. 30: 211 Spindle

formation associated with doubling of cytoplasmic viscosity, followed by a drop.

Anesthetics Σ Et_2O , $CHCl_3$, $AcMe$, paraldehyde, P_2O_5 , $iPrOH$, $PiCOOEt$, $EtONO_2$, H_2CN , H_2NO_2 , $CHCl_3CH(OH)_2$, $PNHCOOEt$, $EtNHCOOEt$, Inhibit spindle and gelation

concurrently. Hypotony stops C.D., but is antagonized by ether.

Heilbrunn '21 J. Exp. Zool. 34:417 see above. Cummingia, cytoplasm 2-3x as viscous at spindle formation.

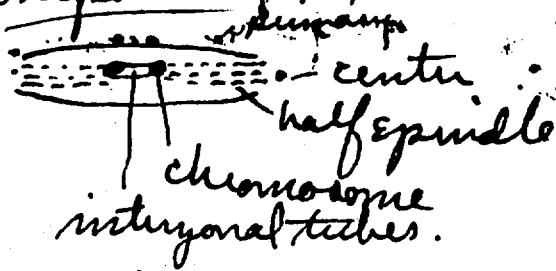
Juyet '35 PSEBM 33:163 centrifuging, 30,000G for 1 hour, Alluris. mitotic cells.

chromosomes completely displaced. spindle in a cone. cf. original article.



McClendon '11 Arch Entom 31:80 .001 amp + anodic accumulation of basophil and chromosomes on spindle. (.003 amp) best dose. (-) charge on chromatin, as expected from acid character.

Schneider '34 B. B. 67:519 "reality of spindle fibres". Centrifuge Cyclops eggs. bending of longitudinal elements without ~~the~~ coagulation. previous components exist.



Schneider '31 Zool 138:386 Probatonia

+synopsis; spindle tubes

Schneider '32 Zool 142:520 Hymenoptera:

tubular integuments + fibres

Schneider '35 Cyt 6:422 Amphiuma

Schneider '36 B.B. 70:484 Tritobone

Schneider '40 Biol Symp 1:87 Mitosis

Meier Bot Gaz 72:113(1921) DC on pea cells

Rabinowitch JM 69:1(1941) Desmodium, Ampel.

Schneider, J. Morph 68:123(1941) Anisodalis

Rachewsky, B. Math Biophys 3(1):1(1941) v. Barber.

elastic contraction.

(Bo) Wilson, E.O. Chondriosomes in development of tissues

JM 52: 429(1931)

Cheney & Klein B.B. 72:384(1937) Cataphoresis

Secari needle -4-, 9 mem. (+).

Rhoades & Uelshammer PNAS 28:433-36 1942

peculiar maysi, preliminary. (Secondary kinetochores.)

Przq, S. Am. Nat. 77:442-462(1943) The usefulness

of spindle fibres for moving chromosomes.

Vayera revere

Turner '39 Nature: 27:205 In *Psidium* -
echinus, micaio thermocouple detects a tem-
perature rise of $.02^\circ$ with peak near the
end of mitosis, then a fall sharper than the
rise. Triton, parallel results.

Vlis '21 CRSG 35:494 Refractive index, S. C.
egg. peak of 1.405 just before end of segmen-
tation.

Keenestring '36 BB 71:188 150000 G 10m
Chrom. Byo cells. Nucleus stratified: nucleolus,
chromatin, euchyterma. Spindle is lighter
than cytoplasm, may be distorted by
centrifuging as by Schade.

Kostoff '30 P. 11:177 *Ant. Nicotiana*. On
the basis of weak evidence, lowest viscosity
is at metaphase.

Laughlin '19 Ann. Inst. Wash.: 265 Statistical
Study on the onion. By following the progress
of a mitotic wave, the duration of various phases
was estimated. This was analyzed against
temperature changes at 10° , 20° , 30° . The

early anaphase has a G_{10} of only .8546
Belar '29 22/ma 10:73 Tridacantha
(hypotony) asubsequent importance to the
Stemenboyer in anaphase movements;
directed at the kinetochore; chromosomes
fairly stiff.
Shimamura Cyt 11:186 (1940) Centrif. PMC, etc

B2 Chemical Stimuli

Allee, Finckel, and Gardner '41 Anat Rec 81:5125

dil. Cu^{++} accelerates C.D. in *Arbacia*

Reid '41 AJB 28:410 Vit. C $\propto \frac{1}{\text{cell size}}$
in *coquea*. High C values associated
with nuclear divisions.

Allee Finckel and Gardner '42 JCCP 26

Cu^{++} More complete account. Crowding
effect. Development accelerated.

Calabrese BA 15:2892 (1939) High K, low Ca
enhance "mitosis rate" in *Vicia*, *Oryza*

Hence, RT J Morph 66:409 (1940)

X-Ray stimulates mitosis in mouse follicle
Meadale '45 AJP 143. Nucleic acid in
regenerating liver.

Ellis '33 JCCP 4:127 See B6b
Hammett '29 P₁ 7:297, '30 P₁ 10:382, '31,
13:261, 331. etc. - SM theory.

Meyer & Claus '39. As Rec 73:17 Viscosity
in cancer cells is higher and may be cause
of abnormalities

B5

B6a. Cyanide, CO, N_2 , H_2S .

Andrews, Chase, Delaney '27 An Rec 37:161 *Arbacia*
can be fertilized in .005% KCN-seawater but
cleavage does not proceed past prophase

Blumenthal '30 Physiol Zool 3:539 *Arbacia*,
KCN ($N/10000$ - $N/100000$), eggs proceed at least 10 microns
before being affected. No direct dependence on
oxygen availability presumed.

Ellis '33 see B6b

Eisenberg '36 Trans Phys Inst Leningrad 16:94

$\text{EtOH}, \text{MeOH}, \text{PrOH} \propto \text{temp, M.W.}$

✓ Ellis '33 JCCP 4:127 *Urechis caupo* eggs

$\text{F}^- \text{ M}/100, \text{AcONa M}/100, \text{lactate } .1\%$ no effect

$[\text{-SH}]$ -SH inhibited somewhat. $\text{CN } .001\text{M}$ inhibited, overcome by methylene blue and dyes $E_0 \leq .17 \geq .02 \text{ V} \therefore$ Carbohydrate metabolism is non-essential.

✓ Zellie '14 JBC 17:121 Various anesthetics

on the S.U. egg after the first cleavage:

$\text{CN M}/8000, \text{CCl}_3\text{KH(OH)}_2, \text{RNHCOET.}$

$\text{Et}_2\text{O}, \text{CHCl}_3, \text{paraldehyde}, \text{EtONO}_2, \text{CH}_3\text{NO}_2, \text{CH}_3\text{CN}$
chloroform are lethal at effective conc. ϕNHAc +
chloroform were ineffective at .5% for 2 1/2 hours. Anesth.
believed based on surface properties.

Rosenfeld '32 Arch exp Zf. 12:570 Et_2O

Chromatin dispersal. Spindle dissolved to a large extent. Reversal of mitosis.

Shalslevich '35 [BA. '36 12589] Zea

H_2 12 hrs. $22-26^\circ\text{C}$ split, pseudotetrads
(C-pairs??) $2n \pm 1, \text{Et}_2\text{O}, \text{same}; 40^\circ$:

stickychromosomes, polyploidy.

Reinhardt '35 BB69 Arbacia: division

but abnormal development in 0.03M
1AcOH.

Traut '41 J.H.30: Sulfanilamide -
polynucleate cells, mechanism still to be
developed.

Thomas, J.A. CRSB 213:890-2 ('41) influence
of sulfa on sea urchin eggs: 1-5% inhibited
development. Not suppressed.

Dunkley + Schriber '38 Arch exp Path Pharmacol 188:208
Caffein particularly inhibits cytokinesis.

Rosenfeld '33 Arch exp Zool 17 NH_3 :
severe clumping of chromosomes. Not due
to $-\text{OH}$ but to NH_3 itself.

Miyenaga '37 Cyt. Frijol: 464 Tradesc. petals
 $\text{CHCl}_3\text{CH(OH)}_2$ - .1% polyploidy, microphite
walls. small spindle Anaphase abnormality,
.25% nicotine, .25% caffeine No phagmoplast
activity. Walls not formed. Cit_2D had no effect
hydration hypothesis.

B6c

Bulmer, '39 Z. Zf. M.A., 29:283 Trypaflavin:

blocks beginning of new mitoses, does not influence detraction, induced chromatin bridges. Fibrocyte culture

Bulmer '33 Cyt. 4:135 Tradescantia:

Methylene blue. longacorn... may inhibit or reverse prophase. Chromosome bridges.

Neutral Red: Sticky chromosomes.

Ether antagonized methylene blue

Blumenthal '28 Phys. Zool. 1:269 Arabica

eggs anesthetized in 5% MeCN 1.5% AcOET 3% iPrOH, 3% n-PrOH, 10% MeOH can be fertilized but do not cleave. CN superimposes an oxygen debt.

Edwards, '36 AJB. 23:483 Neutral salts on

Tea. No aberrancies. Lethal effects $> \frac{M}{30}$.

Koscelin '40 CRAS 210:544 Caffeine, Theophylline

only wall formation is inhibited.

Haywood + Root '32 JCCP 2:177 CO₂ inhibT.

lessened by NaHCO₃. Permeability effect of bases.

Lehmann + Andrews '34 Pl Phys — Tradesc.

No division $< 18^\circ > 41^\circ$ Opt. 28° (69m.)

CO₂-C.D. blkd in V&B: all: Et₂O in V&B

blk, 6 m. CHCl₃ in V&B 60 sec.

Fluorescin no flk.

Lewis MR '33 Arch exp 26 14:464

✓ " " '23 J. Hopt. Hosp Bul 34:373

reversible gelation of spindle at pH = 4.6

'33 Arch Rec 55:164 hepatoma

solated spindle and yielded split chromosomes
as in cancer cells.

'35 Arch exp 26 17:16 Fluorescent X

stilar chromosomes - terminal adhesion,
non-disjunction, pseudo-amitosis.

Sinota & Yuasa '41 Bot Mag Tokyo

halogen + halide no mitotic data

Zinkemagel '32 Ber Bot 50:134 Allium

illuminating gas: a few hrs. Disappearance
of spindle Polar chromosome movement
interfered.

Drudsey & '38 Arch exp Path Pharm 188:198

ant. pit. ext., 10^{-4} inhibited Echinoidivision
Other compounds mentioned. No cytology

Egert '41 Ocala Sci Pr 21:101 hormones + other
compounds affect Tradescanti pollen tube. No details

Physical Agents

Brams + King '40 JCCP low temperature
irreversibly inhibits Ascaus at any stage

Daniel + Challeby '32 2:311 Temperature
characteristic of *Onoclea* division, \therefore C.D. 16,500
Pro. 11700 Ara. 20,200. [see Nulham '31]

Dragoin + Ules '21 CRAS 72:1210
Osmotic pressure. Progressively: polynuclei,
alteration of asters, cyasters, pyrenosis,
granulation, cytolysis.

Dragoin '22 CRAS 174:199 Recovery.
- 30 atm. Yes. " 35 atm. 2 div.
40 atm. No.

Freud '40 Oeta brevis merland 10:39
3-8°C. cold on new born rats, 4 hrs. Cold
less poisonous. Apnoea. Mitosis arrest in
normal metaphase.

Milovidov '38 Pr 30:427 Decalcification of
Vicia roots \rightarrow microploidy. May occur in
nature thus.

Hovare '23 CASB 88:191 Para egg. 0°C-4°C.
achromatic figure unaffected. Telophase

incomplete, some chromosomes and fragments persisting without going into nucleus.

Temp & Juel '31 Arch exp 26: 11:602

5 min. temp, 1-24 hour recovery.

50° 20 min. coagulation; 47°-50° reversible cessation of mitosis 45-46° metaphase block, rotation of spindle.

Lewis, MR '33 Arch exp 26 14:464 Heat vs B:

prevented ~~sub~~ gelation of the spindle.

Maesland '38 JCCP 12:57 Arbacia, hydrostatic pressure. 450 Atm inhibited cortical division.

Patterson '41, ('42) AJB 28:628 Neutral

red sensitizes Hordeum root tips photochemically. The radiation in 1:75000 N.R. \Rightarrow decrease in CD, death....

Pease '41 J. Morphol 69:405 see reprint

1st mitosis Urechis. 3000 lb/in² destroys spindle completely, granular traces remain until > 6000. Chromosome movement slowed at 2000, retarded at 3000 at > 2000 matrix flows out. At relief, cytotax appears.

Near chromosomes, may form half-spindle
which are functional + can pick up chromo-
somes after metaphase. gel-sol transfor-
mation believed important in anaphase
movement and the spindle is compared with
the cortical gel.

Perakis & Cotton '39 CRAS 208:1686 Nega-
tive evidence for magnetic effect.

Ulio & Dragoni '21 CRAS 172:1127
Osm. pressure. In the middle of diastole, placed
into sea-water + sucrose. 30-60 atm. division
rate lowered 60-100 Changes in cell form.

W=πV. For 1st division 4.09 ergs.....

Stilwell An Rec 84:193 (1942) Photodyn.
action, neutral red, fibroblasts. like other.

Creighton & Evans JH 69:187 (1941) X-Rays
on *Chortophycus*. Giant ⁽¹⁹⁴²⁾ cells

Carlson, J.G. J Morph 71:449 3/2 X-Rays
on *Chortophaga* neuroblasts.

Carlson, J.G. CBH Symp 9:104 (1941)

Carlson J Morph 66:11 (1940) 250₂

Hamaya Cytologia (Fuj.) 1036 (1937) D.C. + Tradesc.

Stone, Ann Bot 47: 815 (1933) X-rays

Chase Biol Bull 72: 377 (1937) UV Ureolysis

delays pb formation and cleavage

Helwig J Morph 55: 265 (1933) X-ray Dithiopt

B8 Relative oxygen lack

Amberson '28 Biol Bull 55:79 clrog in
Arbacia is unaffected down to 11 mm. Cleavage
ceases at < 4 mm

Andrews, F. '05 An. Bot. 19:521 H₂ reversibly
inhibits: 1. Prophase 2. Wall formation. CO₂
inhibited all stages. Mitosis occurred down
to 3 mm O₂ in vacuo. Tradescantia.

Brachet '35 Arch. de Biol 45:611 Rana egg
Effects only after 15 hours. Then "premitotic"
figures, vitreous nucleus, hyperpigmentation
Mitosis can regress, cytestes form, or
asters may degenerate to anastrial type. Separation
of astrs from spindle

Laser '33 Bioch Z. 264:72 Child fibro-
blasts can survive anoxia. Tumour like
metabolism.

✓ Hawley '27 Biol Bull 52:147 Chinus +
Stony laurentatus. H₂, red. Me & Bl. Prophase
inhibition.

Haward + Kendall '34 Bioch J 28:1121
Expressed as E_n. tissue culture, division down

to $E_h = .02V$.

Lyon '02 ASP 7:56 O_2 essential 10-15 mins. after fertilization (nucleus + sperm after growth?) sensitivity to CN increases as development proceeds.

De Moor '95 Archde Biol Tradescantia.

N_2 , wall-formation inhibited. same in CO_2 , 7-8 cm O_2 ,

Nabolsch 104 Ber Bot 22:62 Phaselus roots

cess, mitosis in 5 hours of anoxia. Many binucleate

Shoots of Phaselus, Pisum, Helianthus, 23-40 hours anoxia stops mitosis with few binucleates

Stebbins + Steinety '39 AJB 26 abstr.

N_2 Hordeum. mitosis stops immediately, some pericnotic revival after 3-4 days in some specimens.

Steinety. '43, '44 AJB. Effects on mitosis + meiosis. See reprint.

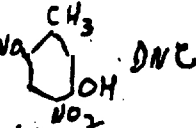
B9. Energy metabolism.

Albaum '42 Zool. Colloquium Col. Un.
Arenicola coeloptile, 1st 72 hours. Cytochrome oxidase system, not through C₄. Time coincidence of enzymes and cell division only basis.

Fischer '41 BB 81:282a Benzoylate inhibits O.C. 55% before touching C.D. ∴ this inhibitor affects energy activity metabolism last.
✓ Fischer '42 JCCP 19:109 Break in O.C.

curve, at point of C.D. block, in urethane concentrations, is evidence for 2 basic systems.

Fischer '42 Fed Proc 29 II. Above O.C. Fraction

Krahl, Clowes, & Kettle '35 Biol Bull  DNC
blocks division in eggs. Sensitivity:

Prophase: Arbacia, Echinaraechmus; all stages
Asterias; Metaphase: Arminiger, Nereis

Mathews '07 AJP 18:89 Nucleus, cytochrome oxidase, centros have substrate. O₂ mild for division. Ancient, unformed. Various inhibitors employed

Vogelstein & Chalkey '35 P. 24. Amoeba

~~H₂S, HCN inhibit prophase; CO is ineffective~~

Pomerat & Willmer '39 J. Exp. Biol. 16:232

Glyceraldehyde inhibition of direct glycolysis and growth (T.C. - Chick peritoneal fibroblasts)

conclusions: direct (anaerobic) glycolysis without phosphorylation, supplies the energy. Evidence is weak and really contradictory. Other aldehydes have same effect on C.D. $.02M F$, $.00005M \cdot$ $1AcOH$, inhibit growth at proper level.

$.002M CN$ after 10 hours mitosis occurred
 $95\% CO$ no effect

$.001M NaNO_3$ little inhibition

$.01M$ malonate, fumarate had no effect. After starvation, lactate stimulated mitosis. "Growth by CO is intimately connected with direct non-phosphorylating glucose breakdown"

Ruhland & Ranshorn '33 Planta 28:471 R.G.

>1.0 in meristems. Fermentation, $EtOH$, $AcOH$, and alcohol dehydrogenases + probably aldehyde " are found there. The O.C. is lower than in elongating tissues.

Voegtlin & Chalkey '35 Pr 24: Amoeba

H_2S , HCN inhibits mitosis - prophase CO is ineffective except in complete lack of O_2 ... mitosis per se is independent of respiration.

Et_2O : irregularities in fission. Na_3AsO_3 does not affect nuclear division but inhibits cell division.

H_2O_2 , As_2O_3 , Mg , $CuCl_2$, $HgCl_2$ have no influence

CO_2 inhibits prophase. HCN as retardants.

The Krahl + Clowes, et al Series
 on Cell Metabolism + Cell Division

B9a
 IT-C

Complete Abstracts K-C papers.
 J.G.P.

1. Krahl, H.E. + Clowes, F.H.A. '36 JGP 20:145-
2. " " '36 JGP 20:173
3. " " '40 JGP 23:401
4. " " '40 JGP 23:413
5. " " Keltch + Neubuch '41 JGP 24:597
6. Hutchins, Keltch, Krahl, Clowes '42 JGP 25: 717
7. Krahl, Jandorf, Clowes '42 JGP 26:233.

1. @ $8 \times 10^{-6} M$, 4,6 ONOC, e O.C. f *Arbacia g. rosea* max
 6 x 10ml U.F., 3 x 10ml F.)) CD s r VsB blk d + bynd e
 r) pk, r VsB o r) r) + s.w. (s blk sm. t. b. m) s/V e loph.
 In y) 6 cp' d' csd e rdc. tm f cyter a p'l mult goxd.
 6 e phenol d n mrl: abt y redox sm. spl " g 10ml
 O-acton. re rny fel p'l. dup. r n cpB f r VsB O-red.
 Vs cp' - r mpla t dTum e r qst emel k p. e r t
 of OC y d: c) r cTl. P (magn) on r dcd. Jly, c thple
 n. 0.0025M @ .00025M e OC f Fg. s blo N/ml @ .0005M e OC
 f Fg. is 2N + dn up blo N/ml utl in VsB DSc.
 @ 20°, 25 min. af T Jly. CD s U m Pd utl OC
 r. max @ Cs p' + CrfT du. s slob or r hb =
 Cs blk s r VsB. E prophase re s/V tm f
 add LT, e mx dv. s r hb: RQ, r un. abt., 94

vs cp: used for effv: DNC, mNP, pNP,
 DNCml, mDNupll, mDNP, hols Eindgral +
 CO flk. MB, NuetRed, $10^{-4}M$: viewable blk
 e rVsb cbn. f DNC - (sum ch c)t' or e Dple
 f SST 2m nymaell Sfc. s sgd e Fe Ho- s PbB
 effv e rVsb der, blk s aso = (limit, f arbc
 mlb; rlr in 0 lb

2 Oc1ccccc1, Oc1ccccc1, also used. sum d e ch..

3. Low O.T. λ_{blk} f CO @ 3-4% @ -CO.C. = 32%
 @ 1% e dt) rTdr. ol. @ Pfy
 CO+O₂ 50% λ_{blk} = @ 2.6, rVsb @ .7% @, 32% r
 CO h n of h o CO d r l n o O.C. z m b rVsb lt
 reu KCN . 52% λ_{blk} = @ $5 \times 10^{-5}M$, rVsb $1.6 \times 10^{-4}\%$
 @ epl λ_{blk} 34% O.C. e Hll redl r) is
 15+%. anolte. λ_{blk} = C.D. l out f PP.
 + O.C., ranging fr 20-106% O.C. @ conc. f
 mix blk.

Cyter n frd, g. blk n mm. Cu pen. n fcv
 Fe found.

4. r) mlb. f DNC d'ced z O.T. s lard e dbe
 f λ_{blk} f C.D. is d'ced y O.T. s lard. Additive

hb₁₁ f anoxia + artfcl redml₁₁ b: DNC
DPT₁₁ : 2 stm. bol stm. ml = @ [DNC]
oe req Cr actot o.c. hb₁₁ bgn. @ e
max. Ae [DNC] > M+M CNs/V ad s hb₁₁

concl Malonic ac. a fcv
ell xTa OC in DNC po. Cu a ml xds stm +
Cu sp. hb = b: ans dr. /AcOH, malonic, DNT,
Ncarvacrol, @ conc. hb₁₁ N ml ad 20-40%

CN hb₁₁ m₁₁ req Pt ~~at~~ / DNC Cr; malonic, flg.
DNC: ac₁₁ o one or M fe redox or fefaultg sp₁₁ ~~at~~
TD in dh Dgnost CNs/V xds stm

5 Although cytochrome is absent, an enzyme
cpb f idcg xds cytes ne Ps / f PP SST. x). ie
Albaciaq. e QO₂ fe Fg. cb hb = nely 80%
b: CN & 50% b: N₃ Co xds s n signifil:

hb = b DNT, etc. " e dc₁₁ fe ad a P'l: c Cnd
- (splg eNg: J dv₁₁ Ps. mb kuzid noe ad
cycle Cu a Cr huz a sm-t huz pt'l Cu
Co too C C: e ^{LD} P₁₁ fe g ad e xds
Ps' s adgt t C: l fe g. ad

6. 2e 2) 6 hours g. use no ~~PTN~~ CbhdT,
PbB: use Ptn

7 Cocarboxylase in 4.F. g. 2-3x / gm.
DaP. aft 2hly. Cytolysates attach pyruvate
bT aerobically. F. g. 7h of V

Oxygen consumption.

Atlas '38 Phys Zool 11:278 Rana. even
respiratory curve from fertilization.

$$y = ae^{kt}$$

Beatty '41 A J B 28(10):15 correlation Q_{O_2}
with mitotic frequency, young larvae.

R.G.'s.

Baldwin '35 J Exp Biol 12:27 R.G. of developing
Limnaea eggs about 1.05

Gray '24 B.R. 1:225 In the Echinus
egg, random fluctuations in O.C. bear
no visible relationship to the cleavage cycle

Chalkley + Voegtlin '40 J Natl Cancer Inst 1: 63

Strong oxidation inhibits C.D. The physiological role of -SH is to act with O_2 in regulation of enzyme synthesis, and thereby nuclear growth.

Krugelis '42 JCCP 19: 377 Phosphatase

found in mouse testis chromosomes.

Litter, Marble, + Salter '37 Am J Canc 31: 268

The extent of NH_3 -spacing by glucose is proportional to the mitotic index in various tissues. Maybe related to glycolysis and nuclear metabolism.

Voegtlin '34 Symp. Gen. Biol II: 84 Synthetic

proteinase require -SH Glycolysis...
nuclear growth...

Willmer '42 J. exp. Biol 19: 11 Phosphatase

found in chick endothelium culture chromosom

Caspussens '38 Chr 1: 147 Gonophoceres:

kinase in nucleic acid absorption spectrum
before mid leptotene, constant till diplotene.

Saehlinger .. '40 J Gen 40: 185 Cold lab

to reduction of chromatin in heterochromatic segments of Paels + Trillium

B11.

Allen, Smith, Gardner 137 A.J. Agr. 61

colch used to ~~accelerate~~ ^{accentuate} growth effects of thielin

Quastion '41 Botan Notiser :310 isolated

Triticum roots. C.D. + elongation vary independently of glucose.

Commoner '40 Biol Rev. CN analysis.

CN_{SB} Proteins? constant in a wide range of materials, about 5% total. Not sensitive to temperature change RQ .8

CN_{SENS} RQ = 1.0

✓ Commoner + Thimann '41 J. D.P. 24:279

analysis links the C_y + growth + respiration only 10% of respiration important.

c1.

Alsop '42 Phys Zool Photodynamic action on
Amoeba lowers protoplasmic viscosity 30%

Blumenthal '27 Biol Bull 52:313 HCN $M/300$

- $M/2000$ increases the rate of water trans-
port in Arbacia in hypotonic sea-water, or
time, conc. HCN. HCN causes a decrease
in volume, perhaps due to hydrolysis \rightarrow KOH

Caryaselli, Rogus, Rappaport '42 ASP BS: 309

Hypertonicity lowers O.C. brain slices

K, Li stimulate O.C., inhibited by Ca^{++} .

Carpusson & Schultzy '40 PNAS 26: 507 Nucleoli

and perinuclear cytoplasm have a high
concentration of ribose nucleic acid in
many materials.

Challinor '37 Pr 28: 489 Nitroprusside,

- SH test in Amoeba. diffuse stain in
mitosis. -n nuclear membrane disappears,
- SH is discharged into cytoplasm.

ka

Ball '42 Wisc. Symp. Resp. Enzymes
 CN lower, H cyt. ox. system < cytochrome.
 In U.F. Asbacia, cyt. ox. is keyed to flavin.

Oxide combines with both oxidized and reduced forms of cytochrome oxidase.

Ballentine '40 JCCP 16:39 By centrifuging dehydrogenase systems are considerably localized in granules.

Barnett '42 J. Exp. Bot 19:88 Ascorbic acid is localized in cells as a diffuse Golgi network.

Bonner '36 JGP 20:1 Indirect relationship respiration and elongation.

Amano '38 Tr. Jap. Path. Soc 10:549 Uric acid found in many nuclei: karyolymph

Gomori '41 JCCP 17:71 Histotechnique for acid phosphatase determinations

Hoagland & Brayn '36 Pl. Phys. 11:471

Aerobic metabolism is a necessary corollary for salt accumulation in roots.

Howard & McClintock '40 JCCP 15:249a.

Avena: 1AcNH_2 $2 \times 10^{-3}\text{M}$ Growth inhibitor
in 24 hours, 30% 9-10 hours 30% . artem
does not appreciably stimulate

* Hunter '41 Anat Rec 81:375 CN, F, Ls.

although change metabolism of Chick egg -
thrytes, do not modify semi permeability

Hutchins, Heltch, Kahl, Clowes '42 JGP

carbohydrates, lactic, NH_3 q.v.

Lillie '18 ANP 45:406 Metabolism necessary

for semi-permeability of sea-urchin egg. The fer-
tilized egg is more permeable. CN, anaesthesia inhibit
permeability, merase.

Navey & Hawey '35 Biol Bull 69:342

The nucleus does not contain most of the
cytochrome oxidase activity. also:

Shapiro '35 JCCP 6:101

CZ

Harvard '35 B. J. Radiol 8: 787 20000R

X-rays had no significant effect on the activity of lactose, glucose, citric or succinic dehydrogenase preparations, (or on cytochrome oxidase).

Albani & Worley, '42 JBC 144: 697

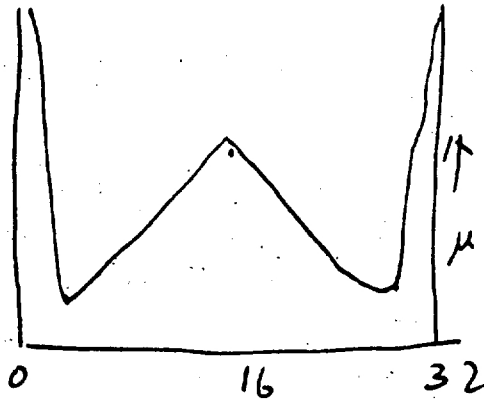
Cytochrome + cytochrome oxidase do not appear in the chick embryo before the 5th day, + $K_2Cr_2O_7$ does not inhibit H_2O_2 before then.

Kitching '39 B. B. 77: 339 Anoxia Paramecium

< .25 min cytolysis eventually. Reversible, not due to CO_2 loss. CO_2 insensitive.

Heilbrunn '24 AJP 68:645 Heat and viscosity

Cummings:



Northern '40 Am J Physiol 59:279

cyclic or distinct viscosity increase in
Spragueia viscosity with MB, neutral red.

Hoffman '33 Bot Mag 95: 279 Allium cepa.

The stele arises from 2-4 cells at the distal end. A pericycle is first differentiated, then one large cell enlarges and grows longitudinally yielding the central vessel. Distal to stelar histogen is the meristem of 3-6 x 2-4 cells. Cortical cells develop from periphery, root cap from lowest layers.

Pollister '41 Phys. Zool. 14: 268 Mitochondrial
alterations in orientations. parallel to diffusion
pattern assumption of parallel orientation of
long protein molecules in hyaloplasm.

2 . Medium for pollen-tube
cultivation: 2g sucrose
0.5g agar
0.5g gelatin
25cc water

D

(Feb 20 '42)

Johnson, Brown + MacIsland '42 Science 95: 201.

Brown, Johnson + MacIsland JCCP 20: 151 (1942)

Temperature, pressure + luminescence

Cyring and Magee, JCCP 25: ~~157~~ 169

absolute v , rates and T

Burton JCCP 9, 1 (1936) Master Reaction Prim

E

et al

Stroughton & Rollefson, JACS 61: 2634,
62: 2264, and 63: 1517 (1941) - Quenching
of fluorescence by ions is a bimolecular ionic
reaction between quencher and activated
dye.

Teorell PNAS 21: 157 (1935) Diffusion
potentials and steady state.

REVIEW.

Zoo 117 Class References

General: Huxley and DeBum

Weiss '38 Principles of Development

Child '41 Patterns and Problems of "

Fertilization: Lillie '19 Problems of F

Lillie & Just '24 in Gen Cyt

Morgan & Plumb

Loeb '13 Art Parthenogenesis

Just Prot 10 (1930)

Tyler Biol Rev 16 (1941)

Sperm Activity Cohen Biol Bull 34 (1918)

Gray BS Exp B IV (1928)

Wimsatt Anat Rec 83 (1942) bot

Fertilizin, etc. Lillie Biol Bull 28 (1915)

Lillie op cit 36 (1919)

Frank Biol Bull 16 (1939)

Tyler PNAS 25 (1939)

Tyler & Fox BB 79 chem

Tyler op cit 81 (1941)

Lillie J Exp Zool 16 (1914)

Tyler PNAS 26 (1940)

Metabolism in development

Warburg Z. Physchem 1 (1908)

Sheard PRS B93 (1922) ~~AT~~

Meyerhof Bioch 2 35 (1911) AH

Regier & Cole BB 49 (1925) AH

Metabolism: Transamination, etc

Beauregard Enzymologia 7 (1939)

Cohen SREng (1942)

Linkages and proteolyses

Bosworth Schmidt: Chem amino ac

Bradley Ph R (1938)

Bergmann Adv Enzym II (1942)

Vogelstein CSH 2 (1938)

Jiving... JBC 144 (1942)

Inductions - Lang CR Carlberg
Fast ligations

Whitaker J. Gen Phys., 15-16 (1931-1933)

Leidahl + Holter C.R. Carlberg 24 (1941)

Whitaker BB 60 (1931)

Zilli ASP 20 (1916)

Moser J E 2 80 (1939)

BB 78 (1940)

Tyler BR 16 (1941)

Häussermann Cellulose Synth 1937 Ch 37

Symp. Cell Biology AAS 1939

Mayer + Glaser BB 71 (1936) C.

Zool 25 - Class References.

Fixation Effects.

✓ Stangerways + Anti G, JMS 71
Belser Zool Abhandlungen + Verbindungslehre
Σ 2/AVJ (1928)

Basic Structure of Cytoplasm

Scientific Science 73 (1931)

Monday Science 84 (1936)

✓ Monday An Rec 72 (1938)

Banga + Bryant Gyorgi Sc 72 (1940)

✓ Pollister Phys Zool 14 (1941)

Wilson An Nature 60. observations

Smith Protoplasma Monogr 11 (1937)

polarized light

Centrioles

✓ Wilson 670-700

Heiden Plasma + Zelle I

✓ Bowen J Morph 39, 351 (1924) ♂

Johnson Z. w. Zool 149: 115 (1931)

Pollister BB 65 (1933)

Fry BB 54, 56, 63, 65

An Rec 46, 56

Jordan Anat Anz 43 (1913) ciliated cells

Benda Arch Anat u Phys (1901) Phys abt

Remyer Zool Anat 73: 338 (1924)

Waller Anat Rec 42 (1929) basalgran
Kindel Anat Rec 34 (1927) cilia + mitosis
Hutterer Zyt 19:119 centrioles in mitosis
Sturdevant J M (1934) " in pascaris
Schrad BB 70 (1936) kinetochore
Pollister PNAS 25 (1939) Molluscs.
1940
Mitochondria

Miesberg (Wilson) older review

Cowdry, Carnegie, 1917.

Lewis & Lewis "Eukaryotic", artifacts

Rumyantsev Arch Zyt 26 (1926)

Ortischow Arch Zyt 26 (1923)

Zensky Arch Anat Rec 57 (1933)

Michalis Arch Anat 55:558 Janus sum

Cowdry Ann N Y Acad Sci 19:423 (1916)

Portier Les Symbiotes (1918)

Wallin Symbiogenesis + Origin p 2p (1927)

Claude CSH IX (1941) chem

Legend CRSB 6, 718 (1908) "↓

Fance-Fremut Arch Anat Rec 11:457 (1910)

" Mayer & Sheffer Arch Anat Rec 12: (1910)

Mayer, Rathny, Sheffer J. de Phys + Path 16:607 (1914)

ibid (1929)

Griseb Pr 1:79 (1929) Rev

✓ Bowers 2 of 9: 1 (1929) Plant
collected 39:123 (1929) Review
✓ Bousley + Hours An Rec 60: 449 (1934)
ibid 69: 341 (1937)

Furcation Kingsbury An Rec 6: 31 (1912) Res
Joyet-Tavaigne Bot 6: 84 sim
Mason Birds 17: 851 (1923) env.
Robinson Aust J Exp B 3: 233 (1926) "
Robinson ibid 3: 97 (1926)
Hornung Engd Cymym 2: 336 (33)
Cowdry Am Nat 60: 157 (1926) gen
deNoy & Cowdry An Rec 34: 313 (1927) synth
Hirsch 3 of 13: 37 (1932)
Authie PRS 1314: 20 ymogen
Bower QR Bot 4: 488 (1928) general
Bower 2 of 9 (1929)
Bill Dullmond - Books 1933, 1945

Rueberg Arch 3 of 4: 602
Weed 3 of 25 (1936)
Goss 3 of 14: 175 (1933)
Solgi Nassanova 1923 1928
Pollister QJMS (1938)
Kirkman + Seeringhaus An Rec (1938)
Jacobs Eng Biol 2: 357 (1927)
Hirsch Protoplasm Monogr 18 (1939) general

Johnson — — —

Parot function

Weier A B 29 BB62 P 19

Bowen 22f 6:689(1928)

Seena

Cell Division

Schnitt + Block PNAS 26 (1940)

Lewis + Lewis Arch 13 (1917)

Zimmerman 2 f B 15 (1923)

Largely Carnegie 265

Rebinovity JM 89 (1941)

Endomitosis, etc

Zentler 22f (1936)

Wilson Arch Intern 13 (1901)

Tellie JER 3 (1906)

Schnitt Coll. Vol 14015(8).145 Kishungins

Spermatogenesis of Mouse, etc.

Cutright, J. Morph 54:197 (1926)

General chromosomal history

Cox J Morph 43:45

The chromosomes do.

Yocum U.S. Calif. Z 16:371 (1917)

^{rudimentary}
Luciford & Galensky PRS B92 (1921)

Direct observations in Rab & Cavy ♂ cytes

Bryden, J. Gen. & T: 415 (1933), 421

Rab and Mouse chromosomes

Zoo 117 11/15/42

Phys 59
theor. cont
11/16/1942

Chamber B.B. 41 (1921)

Child - Arch Entom 135 (1936)

Harvey - BB 81: (1941)

Lillie - Arch Entom 118 (1929)

11/24/42

Morgan & Spooner - Arch Entom 28 (1908)

Hanley - JE 2 45 (1926)

✓ Taylor, Tennant & Whitaker Can. 25 (1926) Y-6

Horstadius - Acta Zool 9 (1928) classic

Horstadius BB (1937)

Darlington, C.D. PRS B121 (1936)

The External Mechanics of the Chromosomes

Friedler, Exp + Fortsch. d Zool 8:3 29-414 1935

Fusome... persistence

↳ Schmidt, W. Chromosome, 1(3): 17 1939 ^{Bytferingues} of the spindle

↳ Barnes & W. J Morph 47: 261-11429 ^{Nicolini}

in caddis fly secretion

Faulkner JH 30: 379 1938 Triploidy

Bacteriology & Immunology G

Pauling & Campbell JACS 62:2643 '40

Antibody Synthesis. also S. 96:181 (1942)

Histological classification of tumours

Sarcomas

Fibroma connective tissue
Chondroma cartilage
Chordoma chordoid tissue
Osteoma bone
Myxoma mucous
Lipoma fat
Angioma blood vessel
Lymphoma lymphatic
Sarcoma: cellular tumours of above
Myoma, myosarcoma;

Leiomyoma smooth
Rhabdomyoma striated

Neurona -

Neuroma

" ganglionae

Glioma glia tissue

Neuro-epithelioma ependyma

Endothelioma

Epithelioma: Carcinoma

Papilloma pavement epithelium + orderly supporting

adenoma ^{tissue} benign glands

Epithelioma atypical arrangement

Carcinoma: glandular, atypical

Consider critically:

1. Spindle relations + Heilbrunn's determinations of cytoplasmic relations.
2. Viscosity effects of anesthetics
3. Actual viscosity effects of colchicine
4. Actual cytological effects of anesthetics.
5. Generality of colchicine effects + the fundamental identity of mitosis (physiol.)
6. Enzymatic effects of colchicine
7. The gradient + experimental conditions
8. Morphology of mitosis, etc.
9. Protoplasmic structure in relation ...
10. Is energy specifically required for C.D. or the maintenance of spindle
 - a. The use of inhibitors in myoplasma works.

Experimental Plans.

1. The fine cytological effects of CN, NaN_3 , Phenylenethane, malonic acid, and colchicine on excised tips + in culture at rigidly controlled experimental conditions.
 2. If intrinsic colch gradient is confirmed, effects of variation in temperature, oxygenation, pH and other reagents on it.
 3. Microchemical tests for the distribution of absorbed colchicine.
 4. Electrical effects on colchicized cells
 5. High pressure on Allium + partly colchicized cells, for additive effects. [see Harland at N.Y.U. see Pease about him.]
 6. Antagonism with hyperbony.
 7. Confirm quenching of eosin fluorescence, and determine possible photodynamic relationships.
-
8. If the colchicine gradient is intrinsic, the effects of CN and other metabolic inhibitors on the absorption and accumulation of colchicine by the root cells. [v. Harland 36]

9. Look for possibilities in Tolsted's
ultra-centrifuge

Bacteriology

Virus

1. Chemistry
 2. Physics
 3. Transplant
 4. Mutation
 5. Medicine
 6. Treatment
 7. Pathology
 8. Metabolism
-

Bacteriophage

Northrop

Jacobs + Falk

O'Herrle

Bacteriophage

Burnet, FM Biol Rev 9: 332 (1934) Review

see for references

McFarlane '39 ~~Chem.~~ BR 14: 223 Chamberl

Read.

Goodpasture '39 Ann Int Med 13:1 3
the chorio-allantois supports many viruses

Martin, Balle + McHenry 139 JBC 130:68g
W metabolin

~~Schneider '36 BB 70:484 bindtobae~~

Carothers '36 BB 71:469 Acrididae:
spindle, etc

Schultz Carnegie Yearbook
Cal Tech Report Put for Expansion
Morgan, S. S.

C	N	P	# and other data										Colchicine - R	
SLIDE	S.#												Results	dose
3	277C1	9	1	26	32	10	1	28	29	11	0	33	21	tot 2 87 82 5 27
3	277B1	11	15	31	27	12	10	17	21	13	11	23	30	tot 36 71 78 5 27
3	282	1	13	33	33	2	12	20	31	3	9	21	27	tot 34 74 101 5 25
3	283A	24	24	29	54	25	22	28	41	26	20	30	41	tot 66 87 136 5 24
3	283B	13	58	10	38	14	38	7	44	15	45	8	48	tot 141 25 130 5 24
3	280B	8	7	53	15	9	4	53	12	10	5	57	24	+ 16 163 51 6 8
3	285	20	0	27	32	21	0	45	50	22	0	60	71	+ 0 122 153 6 1/2
3	328A	25	1	29	32	26	3	28	21	27	5	21	24	+ 9 78 77 6 2
3	329A	25	2	37	42	26	1	30	42	27	4	30	50	+ 7 97 134 6 2
3	330A	21	6	24	19	22	9	29	43	23	9	41	29	+ 24 114 91 6 3
3	330B	16	5	25	22	17	11	18	30	18	10	18	30	+ 26 61 82 6 3
	331B	13	26	11	24	14	16	11	22	15	19	11	16	+ 61 33 62 6 4 1/2
	331C	26	28	6	21	27	35	12	22	28	15	8	12	+ 78 28 55 6 4 1/2
	332	8	73	4	39	9	66	3	34	10	78	3	39	+ 217 10 112 6 8
	333A	14	34	6	10	15	58	4	10	16	62	8	11	+ 154 18 31 6 12
	333B	37	76	11	44	38	69	5	34	39	61	11	36	+ 206 27 114 6 12
	334A	14	21	20	32	15	13	21	12	16	8	10	10	+ 42 51 54 6 22
	334B	13	59	7	27	14	69	15	28	15	54	7	32	+ 182 29 87 6 22
	335A	18	5	14	21	19	2	16	15	20	7	23	31	+ 14 53 67 6 4 1/2
	335B	15	17	8	17	16	13	9	19	17	13	8	16	+ 43 25 52 6 4 1/2
	262	2	1	87	11	13	2	109	13	70	3	87	6	38 1:3 68 15 34 5 +
	262	4	2	64	7	99	1	105	3	45	3	1	64	17 9 2 1/2 292 36 167 5 +
	351A	16	0	24	51	17	0	25	32	18	0	28	35	+ 0 77 114 6 0
	351B	1	0	62	81	2	0	66	73	3	0	82	87	+ 0 190 241 6 0
	353A		1	27	19			22	18			29	23	+ 1 78 60 6 2
	353B	2	0	15	29	3	0	27	30	39	0	16	17	40 0 26 21 6 2
			4	0	23	17								3 1/5 0 64 114 6 2
	355A	1	13	3	20	2	9	4	18	3	9	8	13	4 19 5 21 6 4
			5	12	4	18								3 1/5 37 14 60 6 4
	355B	6	12	7	20	7	10	6	14	8	5	7	23	9 4 8 18 6 4
			10	8	6	20								5 1/5 23 20 57 6 4
	361A	10	18	3	18	11	17	0	31	12	23	0	19	+ 58 3 68 6 7
	363A	A	71	10	5	B	13	0	19	C	11	0	7	+ 35 1 28 6 8
	365A	32	40	1	25	33	54	0	36	34	42	0	18	+ 136 1 79 6 9
	365B	12	44	0	18	13	52	0	19	15	8	2	26	+ 176 2 63 6 9
	367A	2	69	9	29	1	62	3	14					3 1/2 180 18 63 6 10
	367B	15	24	1	8	11	19	0	8					3 1/2 23 2 24 6 10

Summary of experiment by
 with Colchicine: Spring 1942

